

In-situ Thermal Diffusivity Determinations in Three Lead-Free alloys and their Binary Intermetallics

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The thermal diffusivities of three bulk lead-free alloys were determined from room temperature to 120°C. The three alloys were SAC305, SAC387, and SAC405. In addition, the thermal diffusivities of the two binary intermetallic compounds, Cu₆Sn₅ and Ag₃Sn were determined from room temperature up to 80°C. For these studies, cylindrical samples of 6cm diameter and 1cm thickness were used. The thermal diffusivity of the binary alloys showed a slight increase in thermal diffusivity with increasing temperature. This is opposite behavior from Sn matrix that has a rather strong decrease in thermal diffusivity with increasing temperature. In the lead-free alloys substantial differences were observed in the thermal diffusivity both across the sample and at the various measurement temperatures. In some cases the differences were a factor of three. Numerical modeling was performed to better understand these differences. The experimental differences observed between the thermal diffusivities of different measurement pairs in the samples can be explained by the intermetallic orientation and the grain boundary structure.